

GLOBAL WARMING IN MINNESOTA: PLAYING WITH FIRE

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It is a great honor to be invited to speak at this regional conference of the global change research program. I am the director and the prime organizer behind a Minnesota coalition called Minnesotans for an Energy Efficient Economy. My governing Board represents 13 groups with primary interests in energy conservation, sustainable development, neighborhood and rural environment issues and renewable energy. I brought a fistful of brochures that describe our policy and research programs in renewable energy, environmental tax reform, electric industry restructuring and more recently, a public education campaign on climate.

We do not debate whether global warming is real. Like John Browne, chief executive of British Petroleum, we recognize that the reality of global warming is backed by “effective consensus among the world’s leading scientists and serious and well-informed people.” We recognize that human-induced global climate change is almost certainly here now, and that its effects on our state could prove disastrous. The main uncertainty at this point is how rapidly global warming will proceed and whether we can slow it enough to allow ourselves and nature a chance to adapt.

And so, we pose two questions: What does this mean for Minnesota’s environment and economy? What must we do now?

We hold the optimistic view that Minnesotans and all Americans can respond to this opportunity to invest in a cleaner, more efficient energy

future. A nation capable of hurling a telescope around Jupiter is certainly equal to the challenge of reducing its dependence on fossil fuels.

Our organization’s first involvement in global warming issues began in 1991, when we helped pass legislation that required our utility regulators in MN to make a best effort at estimating the societal costs of electricity generation. The public interest community and state agencies in Minnesota worked together in a contested administrative proceeding against a coalition representing the State of North Dakota, the coal industry and all Minnesota utilities. The goal was to reach an estimated economic quantification of the costs of environmental damages from electricity generation.

In a December 1996 decision described as conservative by the Minnesota Public Utilities Commission, the cost of current emissions from Minnesota alone leaves our children a debt in environmental damages of between \$1 billion and \$6.5 billion each year (see Environmental Costs Web Page at <http://www.me3.org/projects/costs>). In the end, activists realized that many of the risks of climate change were not readily quantifiable in market terms. For example, how do you value a potential for species extinction, as habitats and ecological communities are torn apart by rising temperatures or declining precipitation? What cost estimate should be applied to damage to Minnesota’s own Boundary Waters Canoe Area Wilderness and Voyageurs National Park that may suffer massive deaths of the spruce and conifer forests, because these biological systems are at the southernmost edge of their ecological range. Warming is expected to begin moving the boundary of these boreal forests northward, within our lifetime, and according to Daniel Botkin, a prominent forest scientist who consults with the timber industry, the changes could begin within the coming decade.



Figure 1: A view of Enron's Minnesota wind farm. Each turbine will generate enough electricity to supply 200-250 homes. They grace the rural landscape along the Buffalo Ridge north of Lake Benton, MN. Source: <http://www.me3.org/>, Photo: Mark Frederickson, Down River Alliance.

Our group has just begun to talk about these ecological issues, in part to communicate with a wider audience like habitat conservation groups and hunting and fishing lobbies. We've jointly sponsored events with senior or religious groups. We're taking our message into the schools.

Unlike traditional environmental groups focused on preservation and wilderness, our message is one of radical technological transformation. We believe that markets can be transformed and the old technology swept out. In a way, we are more pro-development and proinvestment than your average entrepreneur or stockbroker – we want a rapid and sustained orderly development of new efficiency and renewable technologies.

For example, we are watching with enthusiasm the development of a half billion dollar Minnesota wind industry, with almost 200 utility-scale wind turbines rising on a ridge in southwestern Minnesota as we speak. We impatiently await the Toyota Prius next year, a sedan that will get an honest 70 miles per gallon. We await their American competitors – the fuel cell cars, or hybrid cars or electric cars – that pollute a fraction as much as today's cars, or not at all.

So will global warming prompt the public demand this kind of technology overhaul in their

choice of electricity sources and in their cars? Will the market direct these changes, or will policy makers set the course? Is the public even tuning in?

The director of the NASA's Goddard Institute, James Hansen said in *Newsweek* in January 1996 "the climate system is being pushed hard enough that change will become obvious to the man on the street within the decade." When I read that statement, I called Robert Watson, who was then the White House Science Policy Advisor and is now the chair of the International Panel on Climate Change. I asked Watson if he thought that Hansen's statement was reasonable. He said that Hansen is within the mainstream of climate science and that he may well be right.

I often quote this statement, not for what it says about the climate, but what it says about the potential for public opinion snapping into focus that we have a big problem on our hands. James Hansen appears to have been right: the people of Minnesota may be slowly catching on that something is already amiss with the climate. One year ago, all of America watched on the nightly news the destruction of one of the economic hubs of the State of North Dakota, the city of Grand Forks by what was called off-handedly a 500 year flood. Fargo had received about ten feet of snow that winter, breaking the all-time record of seven and a half feet, and smashing the average annual snowfall of a little more than three feet.

No single weather event is directly attributable to a warming climate, of course, but global warming means increased weather catastrophes. The increasing frequency of freakish storms is becoming apparent to the public.

Last July 1, over 3 inches of rain fell in the Twin Cities in an hour, sweeping several houses off their foundations in neighborhoods with no seeming risk of flooding. Three of the past four winters set top-ten snowfall records in Duluth,

Minnesota. In July 1995, a freak windstorm swept through northern Minnesota and destroyed 6.5 million trees. The Minnesota DNR estimated the economic worth of the downed trees at a third of a billion dollars. This spring Minnesota suffered a Texas-style F4 tornado, cutting a swath of destruction a mile and a half wide and 65 miles long. The public may not understand the huge uncertainties in the connection of severe weather events and the changing climate, but they are well aware of a constant stream of new weather records. At a gut level the public is growing to understand what the pioneer Wallace Broecker of Columbia tells us: “climate is an angry beast and we are poking it with sticks.”

As of last summer, our polls show that two thirds of Minnesotans thought that global warming is a serious or very serious problem. Since then, news of Kyoto has inundated the papers; the linkage to El Niño is cautiously discussed; the Twin Cities most popular weatherman became an outspoken convert; 1997 edged out 1995 as the warmest year on record. This year began with the strongest El Niño, the warmest February ever, the earliest ice-out on northern lakes, and in most people’s minds, spring came a month early (it’s tough to be against that, let me tell you.)

April 1998 finds global warming stories on the cover of *National Geographic*, the *Atlantic*, the *New Republic*, and *Audubon Magazine*. In *Audubon Magazine*, environmental writer Bill McKibben writes of Kyoto and the “strong sense that the tide had turned; for all their money and power, the oil companies and coal barons were now on the defensive... How long that moment lasts will depend, more than anything, on the weather... Another nasty summer, another spasm of storms, another round of reports about increased precipitation and changing seasons... those might be enough to cement this new politics into place.”

In *Playing with Fire: Global Warming in Minnesota*, we argue the idea that Minnesota is at greater risk than many other states. Recognizing large uncertainties, we talk about the work of scientists who study how global warming will affect our farms, forests, waters, and prairies. We gathered the distinguished work of Minnesota’s ecologists and agricultural economists who are thinking about the issue, and try to present their work with an advocacy voice, a call to action, while still respecting the uncertainties and the tentative nature of scientific inquiry.

The climate modelers often predict greater warming at higher latitudes, and our early review of the National Oceanic and Atmospheric Administration’s “best of the best” Minnesota temperature records appear to bear that out. So what could this mean for Minnesota?

A vegetation map of North America shows that in Minnesota the vast prairies of the western states meet the hardwood forests of the eastern U.S. and the mixed conifer hardwood forests of the north. In the furthest northern edge, Minnesota’s wildernesses have the spruce, tamarack and cedars that typify boreal forests stretching all the way to Hudson Bay. Our state is the only place on the continent where these various ecosystems meet. This dynamic mix provides us with a remarkable natural diversity. If, as scientists are suggesting, the earth warms by 3-7 °F over the next fifty to one hundred years, and warming is in fact greater at northernmost latitudes, that diversity will be threatened.

Of greatest concern is the pace of global warming. Margaret Davis, a University of Minnesota Regents’ Professor and a member of the National Academy of Sciences is here with us tonight. She has for many years researched the migration of tree species in North America, and concludes that many tree species may not be able to extend their ranges northward fast



Figure 2: North shore of Lake Superior. Source: Minnesota Extension Service, Dave Hensen, September, 1992.

enough to keep up with the change in climate. According to Professor. Davis, “If the change occurs too rapidly for colonization. . . , population sizes may fall to critical levels, and extinction will occur.” In other words, entire forests could die, unable to adapt to new conditions.

Another University of Minnesota ecologist John Tester presented a slide show to a roomful of Minnesota legislators meeting at Lake Itasca, the headwaters of the Mississippi. Only a 5 °F difference in average annual temperature between the climate enjoyed by the stately pines of Itasca State Park, and the prairie lands that stretch westward to the Rockies beginning only 40 miles away. Itasca State Park is the crown jewel of a great Minnesota State park system. Some computer models forecast warming for that region possibly much higher than 5 °F. If that happens, the forests of Itasca could disappear. Indications that northern latitudes would warm faster would put Minnesota north woods and lake country at a deeper risk than southern farmland. This is doubly unfortunate, because these resources are the most vulnerable, and represent the greatest biological diversity.

Forest ecologist Daniel Botkin has also studied the impact of global warming on the forests of the Great Lakes region. He has predicted that drier, warmer conditions will reduce soil mois-

ture, contributing to increased plant pests and diseases and forest fires. “The dominant species [will] shift from those with commercial value to those of little commercial value,” he writes.

Some scientists and economists have projected that increased carbon dioxide would fertilize trees and boost their growth, and that productivity could increase in commercial tree farms. James Teeri from the University of Michigan has studied the impact of increased CO₂ on aspen trees and has found that, in the long run, though aspens grow faster and larger, the quality of their wood is reduced, and the effects on the surrounding ecosystem are negative.

We also summarize the enormous uncertainties associated with agriculture in a changing Minnesota climate. Longer growing seasons are attractive on their face to farmers, but to temper farmer enthusiasm for a warmer climate, we cite Cynthia Rosenzweig, a research agronomist at NASA/Goddard Institute for Space Studies, and Daniel Hillel, professor emeritus of plant and soil sciences at the University of Massachusetts. They have looked extensively at yield and costs associated with increased pests and weeds and drought. Their new book *Climate Change and the Global Harvest* published just last month by Oxford University Press.

We argue that Minnesota’s agriculture is too important to take a big gamble. In 1996, our agricultural exports totaled \$3 billion and ranked seventh in the nation. Many of our communities depend on agriculture for economic and social survival. Our coalition has worked in Minnesota to get farmers involved in opportunities with renewable energy sources such as wind power and biomass.

Minnesota’s 12,000 lakes are a gift to us from glacial retreat and a climate cool and wet enough to maintain them. Our lakes are tourist destinations and our sport fishing industry brings in



Figure 3: Great Blue Heron. Source: Don Breneman, *Visualizing the Great Lakes*, <http://www.epa.gov/glnpol/image>.

about \$1 billion a year. One quarter of all Minnesotans, over a million people, are expected to be on a lake for this Saturday's fishing opener. Since way before a Minnesota Governor held up a northern pike on the cover of *Time Magazine* in 1973, lakes and streams have been synonymous with the good life in Minnesota.

Rising levels of greenhouse gases will create a warmer, drier climate that could severely affect our lakes and streams. If drier conditions are expected to accompany global warming, it will result in lower lake levels and river flows, warmer water and reduced water quality, and the deterioration of fish habitat in many areas. Lakes in northern Minnesota could see ice out four to five weeks earlier and ice and snow thickness reduced by 50 %, endangering ice fisherman and snowmobilers.

Again, northern lakes may be more severely harmed than southern Minnesota lakes. David Schindler, a limnologist at the University of Alberta, studied a group of lakes in Ontario just 120 miles north of the Boundary Waters Canoe Area (BWCA). The boreal freshwater eco-

systems he examined are similar to those of the BWCA.

Schindler's study showed that during a 20-year period, the mean annual water temperature increased 3.6°F. Drying caused declines of over 50 percent off and led to fires in the area. Such changes in temperature and precipitation would have devastating effects on the ecosystems of the BWCA and Voyageurs National Park.

Elevated water temperatures may reduce trout habitat in 50% of northern Minnesota

lakes. With warming at the upper bounds of estimates from a carbon dioxide doubling, in all likelihood, trout would disappear from southeast Minnesota streams and North Shore rivers.

Minnesota's prairies once had 7 million acres of wetlands. Today, only 20% of those acres remain. Prairie wetlands depend on reliable precipitation and consistent temperatures, both of which global warming would threaten. The mallards, pintails, and blue-winged teals that breed in wetlands would be severely affected by the higher temperatures predicted by global models.

The danger to wetlands would come from dryness as well as heat. W. Carter Johnson, professor of ecology South Dakota State University, found that if temperatures increase 3.6° to 7°F, precipitation would have to increase 10 to 25% just to maintain the current status of prairie wetlands. But that sort of precipitation increase may not happen under global warming. Some models show a loss of 50% or more in soil moisture. Johnson expects wetlands to be choked with cattails, which would reduce the habitat

quality and number of ducks. Many wetlands might be lost completely.

Eville Gorham, a prestigious University of Minnesota ecologist, has also pointed out that warmer, drier conditions pose the threat of peatlands increasing their emissions of CO₂. Peatlands are waterlogged lands made of dead reed cattails, sedges, and sphagnum moss. They hold huge amounts of carbon that would be released into the atmosphere if the water tables fall as the result of higher temperatures and greater dryness. The carbon dioxide given off would exacerbate global warming.

He also points out that while peatlands naturally burn, drier conditions could produce sustained burning of peat underground for years. He likened such fires to a “Kuwait of the North.” This worst-case scenario could enormously increase CO₂ emissions, through a massive and uncontrolled burning of what is essentially a fossil fuel.

What Can We Do to Make a Difference? Early and Decisive Domestic Action Is the Answer.

Last year, an internal debate raged within the Clinton Administration whether we could reduce our global warming emissions without hurting the economy. Economic predictions of the impact on the U.S. economy from reductions in greenhouse gas emissions vary widely as a result of the differing assumptions built into the economic models.

Models based on worst case assumptions predict a reduction in GDP growth, while others based on best-case assumptions predict stimulated economic growth. Generally, I agree with Dan Lashof, the top climate guy at the Natural Resources Defense Council that if you torture an economic model long enough, it will confess to anything.

Last year the group Redefining Progress in San Francisco found five prestigious economists to propose a simple statement on climate. The group succeeded in collecting 2500 additional signatories (including several Nobel Laureates) of the Economists’ Statement on Climate Change. If you think it is hard to get scientists to agree on something, try economists. But more economists agreed on this statement than any other petition previously circulated. In part, it says “For the U.S. in particular, sound economic analysis shows that there are policy options that would slow climate change without harming American living standards, and these measures may improve U.S. productivity in the long run.”

One example of these analyses was completed last year in May, the Energy Innovations report by five major environmental organizations. They found that with policies targeted at the electricity sector and the auto sector, emissions could be reduced 30-40% by 2010 and save the economy money. Largely, this is true because efficiency is cheaper than waste.

The Panel on Energy Research and Development of the President’s Committee of Advisors on Science and Technology has pointed out that many of the improvements in energy technology that would slow global warming would have additional benefits. These include reducing dependence on imported oil, expanding U.S. technology exports, reducing air and water pollution, fostering sustainable economic development, and strengthening U.S. leadership in science and technology. In other words, even if there was no climate problem, we would be advocating for energy efficiency, clean energy, and better transit and land use.

If we move forward toward this future, we can enjoy cleaner more breathable air, fewer cases of asthma, more comfortable and economical homes, quieter and more livable neighborhoods, new markets for environmental technologies,

convenient transportation, and diversified rural economies through wind energy and biomass energy. So if we are very lucky, and it turns out that the warming at the lowest end of the estimates, what have we lost by cutting emissions? The IPCC estimates that benefits such as reduced air pollution could offset between 30 and 100% of climate abatement costs.

Every time humankind has switched from an existing fuel to a newer one - from wood to coal, coal to oil, oil to natural gas - the switch has been associated with economic progress. The same is true for alternative fuels. States and nations who lead the transition to alternative energy will enjoy an economic advantage. As the world demands energy-efficient technologies and environmentally safe fuels, upper Midwest states should seize the opportunity to incubate these industries of the future. Visit our web site at <http://www.me3.org/> to learn about pro-renewable and pro-efficiency policies that can be implemented with the restructuring of the electric industry, or about a national movement in the states to shift part of existing tax burdens onto pollution.

The emphasis for the United States must be on domestic action to reduce its emissions, not trading for the unused emission credits of a collapsed Russian economy. Complex equity issues arise when Senators and the President prevent the U.S. from reducing its emissions until international negotiations achieve "meaningful participation" by key developing nations. Currently the richest 10% of American annually emits 11 tons of carbon dioxide each, whereas the poor people of the world emit (on average) a tenth of a ton, even if the clearing of forests and burning of grasslands are all attributed to underdeveloped nations.

On the other side of this debate, the Energy Information Administration released a report in April predicting that, without major economic

or technical changes, world emissions will surpass 1990 emissions by 80% by the year 2020. Contrast that increase with the call by the International Panel on Climate Change for a 60 to 80% reduction in emissions to stabilize the climate.

Most of the increase in emissions come from developing nations, so it is a deep and troubling problem to balance the fairness arguments of the developing nations against the climate imperative to reduce emissions by two-thirds or more. So worldwide, do not expect changes in population and technology and lifestyle to come easily. A Kyoto delegate asks why Americans expect to ride two to a car, while counting on developing nations to reduce riding the bus. Apparently he has not enjoyed watching the on-ramp at rush hour in any major American city. If the rich western nations do not lead with low- or zero-emission transportation and energy systems, who will?

Following the Kyoto agreement, my hopes soured a bit that the tide had turned, that the oil and coal interests were set back, and the world would be moving toward sensible reductions. Since then the national rhetoric has been anything but reassuring, with anti-Kyoto resolutions percolating up in legislatures in several states. When it comes time to do our part, we seek the easy road. This past month, the President announced his agenda for restructuring the electric industry, and missed the easy opportunity to make a big step toward his own emissions goals for 2010. He should have called for Congress to require that all coal-fired power plant that are exempt from the Clean Air Act Amendments be required to meet modern standards.

Often I am told that the climate problem is indeed global, and Minnesota's emissions are small by comparison. My one Midwestern state represents 2% of U.S. emissions, and since the U.S. represents 25% of the world's, Minnesota

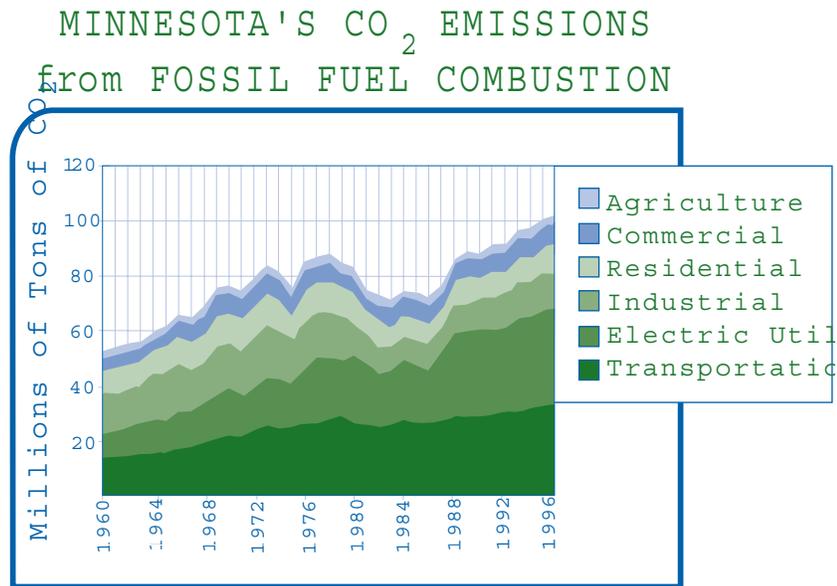


Figure 4: Minnesota's CO₂ Emissions from fossil fuel Combustion;
Source: Minnesota Pollution Control Agency.

is responsible for about 1/2% of the global total. That is more than many countries, such as Iraq or Ecuador, so if countries should plan for reductions, why shouldn't states? There are six midwestern states well represented at this conference. I haven't checked emissions from each, but I expect some are a little more than Minnesota's and some a little less. Using MN as an average, these midwestern states represent more than 3% of the world's total output—maybe as much as 5% considering Michigan's and Illinois economy. If forward-looking, well-educated citizens from Wisconsin Michigan and Indiana and Minnesota won't lead, then who? If automotive and utility strongholds like Chicago and Ohio and Detroit won't lead, then who?

Our group released our report this spring at the Minnesota Science Teachers annual convention, and we have spent time talking to middle school children about the problem. When they ask me why I spend time in schools, instead of talking to adults, I give them three reasons: first, adults are too busy working, paying bills and raising children to focus on this—they should study it

themselves and explain it to their parents, I tell them. Second, adults sense that things will be as they have been, and they have a hard time imagining the changing climate is upon us, and that we have an option to reduce its impact by early action. Kids, on the other hand, have great imaginations and can easily envision switching to cars and power plants that don't pollute. Lastly, I tell them that the problem will be more theirs than ours. I quote them Tom Karl, now head of the National Climatic Data Center — where by the way, you can get the “best of the best” data sets for temperature changes at various sites in your state. Tom Karl says: “If you look out your window, part of what you see in terms of weather is produced by ourselves. If you look out the window fifty years from now, we're going to be responsible for more of it.” When I ask them why we called our report *Playing with Fire*, they are silent for a minute. Then they offer that global warming is mostly caused by burning fossil fuels — and that this is a very risky time. I remind them that playing with fire can quickly get out of control in surprising and unexpected ways.